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A NEW SET OF CLOUDINESS CHARTS FOR THE UNITED STATES.

By KENNETH McR. CLARK.

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A NEW SET OF CLOUDINESS CHARTS FOR THE UNITED STATES.[1]

By KENNETH McR. CLARK.

[*From the* Quarterly Journal of the Royal Meteorological Society.
Vol. XXXVII. No. 158. April 1911.]

In 1891 Gen. A. W. Greely published a series of twelve maps[2] showing the mean monthly cloudiness for the United States. The data for these maps were found in the records of the Signal Service, of which he was Chief. The longest period for which data were available was 18 years (1871-1888). Many of the stations had been established for a shorter period, some for less than five years. The only other cloudiness chart published since then for the United States is the mean annual chart in the *Report of the Chief of the Weather Bureau* for 1896-97.

Data for a much longer period now being available, it seemed well to construct a new set of charts. For compiling the accompanying table data have been used from 77 stations, at which the averages are based on periods of thirty years or more. There are also 31 stations with periods of less than ten years, and 15 with five years or less. As cloudiness is determined in tenths of the sky covered by clouds, by daily eye observations, the number of which per day has varied at different times, it is obvious that the personal equation of the observer plays a large part in the results. The short-period stations have been given less weight than the longer-period stations. There are a few longer-period stations whose data differed so much from those of the surrounding stations that they also were given less weight (*e.g.* Evansville, Ohio). It was impracticable to reduce the data to a uniform period. Topography, as is well known, influences local cloudiness to a large extent, and hence certain stations whose figures at first seem abnormal are shown (*e.g.* Elkins, W. Va.; Baker City, Ore.). A few other stations whose cloudiness seems to be topographically influenced have been omitted, because the scale of the map did not permit them to be shown without too much complication (*e.g.* Mt. Weather, Mt. Tamalpais). The object throughout has been to generalise broadly, rather than to present details which would unnecessarily confuse the lines.

The most marked features appear over the Pacific Coast and the Great Lakes. On the North Pacific Coast the combined effect of the Coast ranges and the on-shore Westerly winds causes a high percentage of cloudiness, especially in winter, when the northern storm track swings

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[1] This report was prepared in the course in Climatological Research at Harvard University, under the direction of Prof. Robert De C. Ward, and forms a companion study to K. S. Johnson's "Mean Monthly and Annual Relative Humidity Charts of the United States," *Report So. Afr. A.A.S.*, 1906, pp. 161-168.

[2] Gen. A. W. Greely, "Charts showing the Average Monthly Cloudiness of the United States," fol., Washington, 1891.

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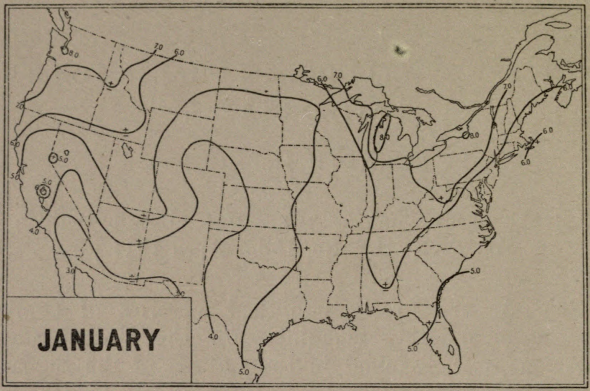


FIG. 1.

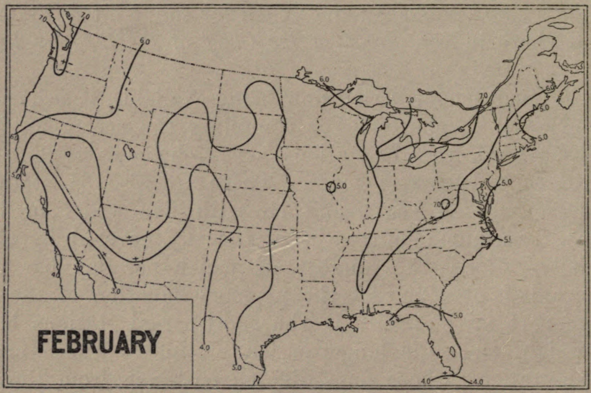


FIG. 2.

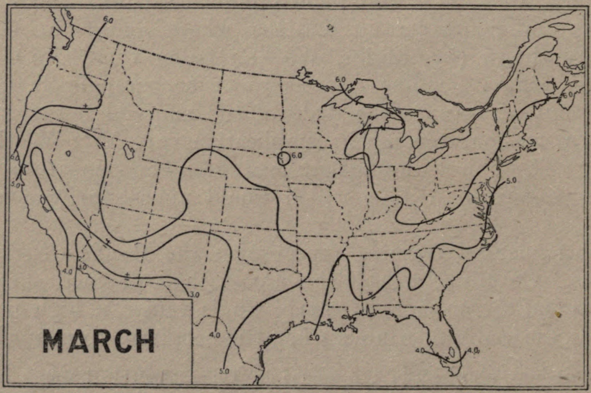
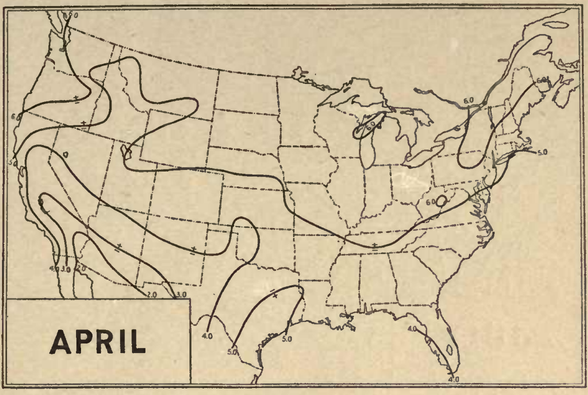


FIG. 3.

Maps showing Mean Monthly Cloudiness for the United States.



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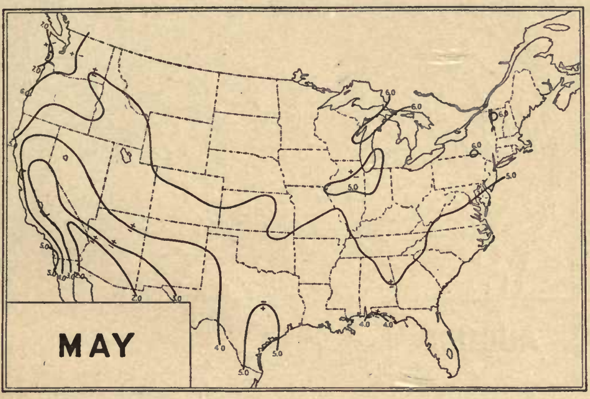

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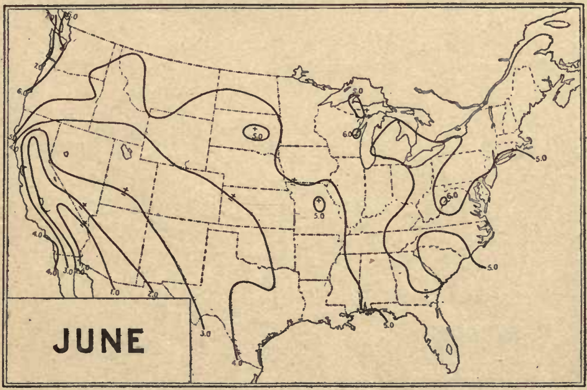

FIG. 6.

Maps showing Mean Monthly Cloudiness for the United States.

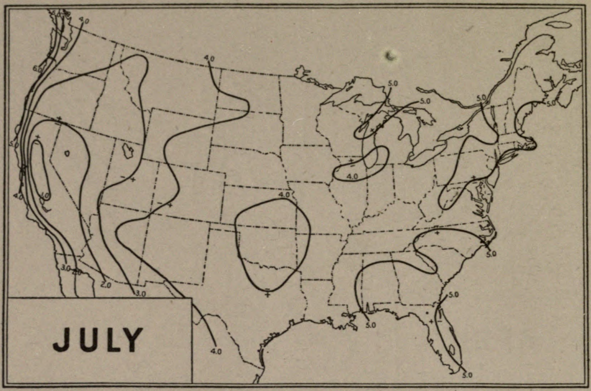

Fig. 7.

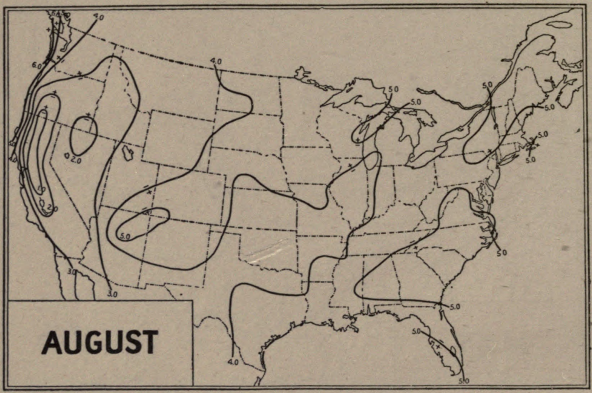

Fig. 8.

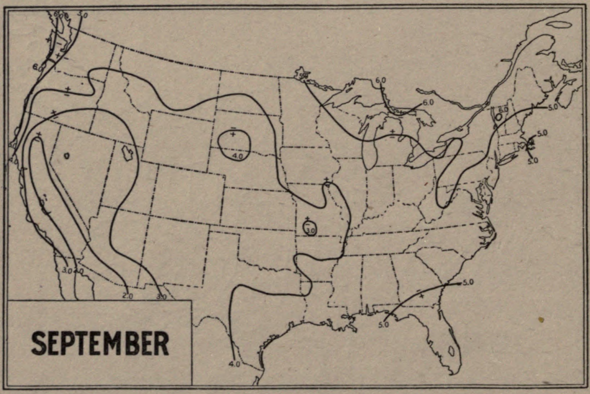

Fig. 9.

Maps showing Mean Monthly Cloudiness for the United States.

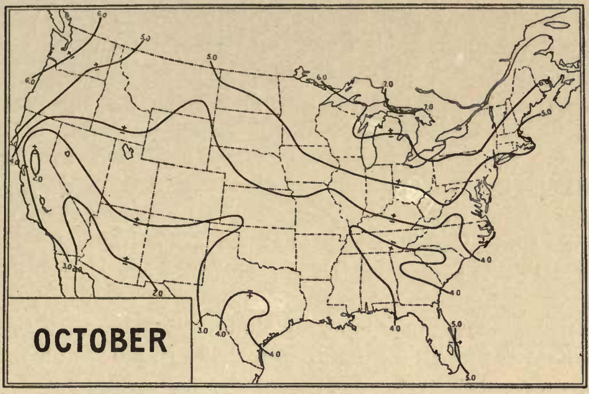

FIG. 10.

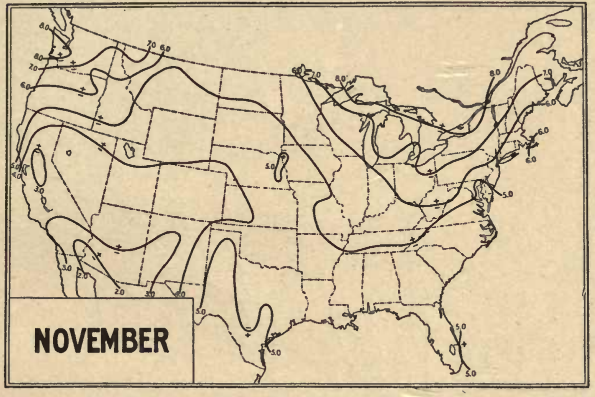

FIG. 11.

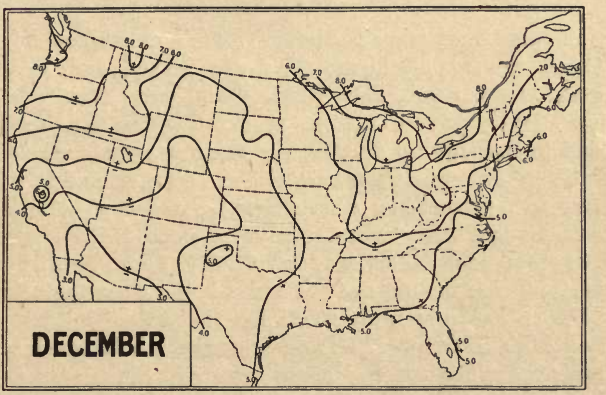

FIG. 12.

Maps showing Mean Monthly Cloudiness for the United States.

down over this region. The Great Lakes region shows a similar large amount of cloudiness, especially in the winter, because of the location on or near the northern cyclonic track and the presence of the water surface. The California Valley, protected from moisture-bearing winds by the Coast ranges, shows the minimum of cloudiness for the country. The local high cloudiness at Fresno, in this valley, in winter, is due to Tule fogs. During the late spring, summer, and early fall, San Diego shows a cloudiness higher than that of adjacent stations. This is due to the occurrence at these times of the so-called "permanent Yuma low" over the Colorado River Valley, which produces an indraft of moisture-laden air from the Pacific across San Diego, causing what is locally known as "high fog."[1]

In comparing these new monthly cloudiness maps with those of Gen. Greely, it is seen that in a general way they are much alike. There is a tendency in these later maps to show a higher cloudiness on the North Pacific Coast, the Appalachians, the Great Lakes, and, in April, July, and August, over northern New England and New York. In May these maps show slightly more cloudiness than the earlier ones over the Ohio Valley, and in the autumn months the same is true for the Great Basin Region. These differences are very slight, however, and it would appear unnecessary to construct any more charts, on the basis of data covering longer periods, until many more years have elapsed.

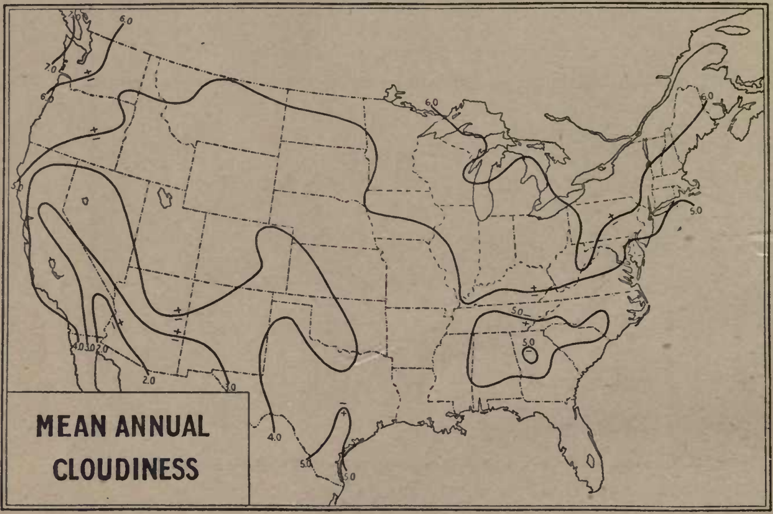

Fig. 13.

In his *American Weather* (pp. 65-66) Gen. Greely gives the minimum cloudiness for most of the United States as coming in August; for the Upper Lakes in July; and for the Atlantic Coast from New Jersey to Florida in October. These statements hold good for the new charts, except that August has about as low a cloudiness as July over the Upper Lakes. The minima, according to Greely, come in January

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[1] This fact was first brought to the writer's attention by a letter from Mr. Ford A. Carpenter, local forecaster at San Diego.

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for the Pacific, South Atlantic, and Gulf States; in December for New England and west to Michigan and Illinois; and in March, April, and May for the Missouri Valley and Rocky Mountains. Except that December shows as high a cloudiness as January on the North Pacific and Atlantic Coasts, if not a higher degree, and that November is very close to December for New England and westward to Michigan and Illinois, these statements are borne out by the new maps.

In comparing the new mean annual chart with that published in the *Report of the Chief of the Weather Bureau* for 1896-97, it appears that the new map shows a higher percentage of cloudiness over the Great Basin region and Southern Rockies, and also over the South Atlantic States. Otherwise the two maps are in general much alike. The earlier map was drawn on a basis of 5 per cent isonephs, whereas the new chart shows every 10 per cent. The 10 per cent basis was used in order to avoid the complication of too much detail, especially where the lines are close together, as on the Pacific Coast.

The accompanying table gives the mean monthly and annual values for the various districts, and has been compiled from data furnished by the kindness of the Chief of the Weather Bureau.

MEAN MONTHLY AND ANNUAL CLOUDINESS.

DISTRICTS.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
New England	5·9	5·3	5·7	5·5	5·5	5·2	5·1	5·0	5·2	5·4	5·8	6·1	5·5
Middle Atlantic	5·8	5·5	5·7	5·2	5·0	5·0	4·9	5·1	4·6	4·8	5·3	5·8	5·2
South Atlantic	5·3	5·3	4·9	4·6	4·5	5·0	5·2	5·2	4·7	4·0	4·5	4·9	4·8
Florida Peninsula	4·8	4·3	3·8	3·8	4·4	5·2	5·0	5·2	5·4	4·7	4·5	4·7	4·6
East Gulf	5·7	5·6	5·0	4·9	4·7	4·7	5·4	5·2	4·6	3·9	4·6	5·5	5·0
West Gulf	5·3	5·6	5·1	5·1	4·8	4·3	4·1	4·0	4·2	3·7	4·6	5·2	4·7
Ohio Valley and Tenn.	6·4	6·2	6·0	5·3	5·0	5·0	4·6	4·5	4·4	4·4	5·7	6·3	5·3
Lower Lakes	7·4	6·8	6·6	5·7	5·4	4·9	4·5	4·6	4·8	5·9	7·3	7·7	6·0
Upper Lakes	6·9	6·3	6·0	5·5	5·5	5·1	4·6	4·7	5·2	6·0	7·1	7·3	5·8
North Dakota	4·9	5·0	5·6	5·3	5·5	5·4	4·4	4·0	4·4	5·2	5·4	5·4	5·0
Upper Mississippi Valley	5·4	5·2	5·7	5·2	5·3	5·0	4·3	4·2	4·3	4·6	5·3	5·8	5·0
Missouri Valley	5·0	5·2	5·7	5·6	5·1	4·9	4·2	4·1	4·0	4·1	4·8	5·2	4·8
Northern Slope	5·1	5·1	5·4	5·1	5·5	4·8	3·7	3·9	4·0	4·4	4·8	5·2	4·8
Middle Slope	4·1	4·4	4·6	4·6	4·9	4·0	4·1	3·8	3·4	3·4	3·9	4·1	4·1
Southern Slope	4·4	4·8	4·4	4·7	4·4	3·8	4·5	3·9	3·8	4·6	5·2	5·0	4·4
Southern Plateau	3·4	3·6	3·7	2·8	2·7	2·0	3·3	3·7	2·5	2·2	2·8	3·2	3·0
Middle Plateau	5·1	5·1	5·0	4·5	4·1	3·3	3·1	3·3	2·9	3·3	3·9	4·8	4·0
Northern Plateau	6·7	6·2	5·8	5·2	5·1	4·6	2·7	2·3	3·6	4·6	5·8	6·8	5·0
North Pacific	7·5	7·1	6·6	6·2	6·3	6·1	4·6	4·6	5·3	6·3	7·5	7·8	6·3
Middle Pacific	5·6	5·6	5·4	4·4	4·0	3·3	3·5	3·6	3·4	3·8	4·5	5·4	4·4
South Pacific	4·5	4·3	4·5	4·0	4·1	3·3	2·8	2·8	2·6	3·1	3·3	4·3	3·6

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